

Forces:

1. Newton's Laws:

- Object in motion/at rest stays in motion/at rest unless acted upon by outside force.
- Net force equals mass times the acceleration.
- When one body exerts a force on a second body, the second body exerts an equal and opposite force on the first body.

2. Variables (units): Force (Newtons: N; $\text{kg}\cdot\text{m/s/s}$), mass (kg), acceleration (m/s/s).

3. Important information:

- Direction of net force and acceleration is the same.
- In many problems, the forces in the x- and y-directions may be analyzed independently, and then combined through another force equation or a triangle.
- Friction and drag act in the direction opposite the motion of the object, parallel to the surface on which the object is moving.
- See Force Problem Types for information about different scenarios.

4. Types of forces:

- Applied
- Friction
- Weight
- Tension
- Drag
- Normal

5. Free-body diagrams:

- Draw forces perpendicular to each other (break down into components if force is at an angle).
- Draw all forces acting on body, unless told to ignore a certain force.
- Arrows are needed to give direction of forces.
- Lengths of arrows should be approximately equal to magnitude of forces. If the magnitude of the forces is unknown, then simply draw an arrow of some length.

6. Weight:

- Acceleration is acceleration due to gravity: 9.8 m/s/s .
- Always in the downward direction (on Earth).

7. Friction:

- Coefficient of friction is the measure of how difficult it is to drag one object across another object. It has no units.
- Calculated by: Force of friction = (coefficient of friction)(normal force).

8. Normal:

- Always perpendicular to a surface.
- Must have a surface to have a normal force.